ABSTRACT OF THE DISCLOSURE

In order to produce insulator structures (8), insulator trenches (21) with aspect ratios of greater than 4:1 are introduced into a semiconductor substrate (1) from a substrate surface (10) and filled with an insulator filling (3). The insulator filling (3) is formed from a plurality of portions (31, 32, 33, 34) which are deposited successively in situ in an HDP/CVD process chamber in the course of an HDP/CVD deposition process. A main layer (33) is provided made from fluorine-doped silicon oxide with good filling properties. A barrier layer (32) is formed directly before the deposition of the main layer (33), said barrier layer preventing an outgassing of the fluorine from the fluorine-doped silicon oxide (33), an interaction of the fluorine with the semiconductor substrate (1) and a formation of defect areas (6) with oxide of low quality in the area of the insulator filling (3). The barrier layer (32) makes it possible to form nondegrading p-channel transistors (73) in the area of the substrate surface (10). An additional layer (31) and a termination layer (34) respectively effect an adaptation and linking of the main layer (33) and of the barrier layer (32) to preceding and succeeding process steps.